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Agenda item 5

# IMPLEMENTATION OF THE RECOMMENDATIONS OF THE SECOND UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE

## Information on opportunities in the USSR for education, training, conduct of scientific research and receipt of scholarships for the purpose of expanding cooperation in the peaceful uses of outer space

Working paper submitted by the USSR

Addendum

## OFFERS BY EDUCATIONAL INSTITUTIONS AND SCIENTIFIC RESEARCH INSTITUTES OF THE MINISTRY OF EDUCATION OF THE USSR AND THE MINISTRY OF NATIONAL EDUCATION OF THE BYELORUSSIAN SSR OF COOPERATION IN THE PEACEFUL USES OF OUTER SPACE

1. The A. M. Gorky Kharkov State University

The University offers to cooperate in the conduct of research on:

- Astronomy;

- Improvement of observations of space objects (use of holographic telescopes);

- Investigations of circumterrestrial outer space and radio-wave propagation;

- Experimental nuclear physics.

Training and improvement of specialists' qualifications in these fields:

- Search for planets and stars using space technology;

- Thematic mapping of the surface of planets (including the Earth) for physical and environmental studies.

The Kharkov State University and the astronomical observatory attached to it are cooperating with specialists from the United States of America, Italy, Poland, Finland and Sweden.

The University's astronomical observatory is participating in the International Solar Observation Programme, in determining the parameters of the Earth's rotation and in the international programme for observation of the coordinates of disputed stars.

For conducting investigations of circumterrestrial outer space and radio-wave propagation, as well as for training specialists in this field, a modern scientific and technical base has been established at the Kharkov State University, centring on a radiophysical observatory where a number of radiotechnical systems are available. Work is being completed on putting into operation a multipurpose ultra-high frequency unit for sounding the atmosphere and the ionosphere. Mobile units are available for conducting measurements by the vertical and Doppler sounding methods. Measurements can also be carried out on board scientific research ships.

In this area of activity, the Kharkov State University is in a position to participate in international programmes and joint international experiments, including investigations of the environment through active experiments in outer space. Joint experiments can be conducted both in the USSR and abroad (including experiments involving the use of equipment developed at the University).

The following activities are proposed for inclusion in international programmes:

- Modernization of existing and development of new instrumentation packages for routine diagnosis of the parameters of circumterrestrial outer space by radiophysical methods;

- Development of new methods for diagnosis of the parameters of the ionosphere;

- Theoretical and experimental studies of the mechanisms whereby pertubations are generated and propagated from sources of various kinds.

The Kharkov State University trains specialists with a broad grounding in astronomy, as well as specialists in nuclear physics and cosmic-ray physics, radiation physics and space radio physics.

There is a graduate school for Soviet and foreign nationals. The University offers to exchange specialists and post-graduate and undergraduate students for the purpose of conducting joint activities and improving their qualifications.

2. The S. Ordzhonikidze Moscow Aviation Institute

The Applied Mechanics and Electrodynamics Research Institute and the Cosmos International Science Teaching Centre of the Moscow Aviation Institute are active in scientific research and education in the field of space technology. Proposals have been drawn up for the construction of the Sadko automatic spacecraft, based on the Phobos spacecraft, to study microgravitation and materials science, conduct spectral observations of the Earth's surface and atmosphere to provide data for use in environmental sciences, meteorology and agriculture, and study circumterrestrial space and Sun-Earth linkages. Steps have been taken, inter alia through UNESCO, to internationalize the work on this project and attract foreign funding.

The Cosmos International Science Teaching Centre organizes international aerospace summer schools and lecture courses for Soviet and foreign specialists, and is preparing together with Eurospace for the conduct of the "Soviet-American Space Industry Dialogue" seminar in April 1991.

The Aviation Institute puts forward proposals for the organization of an international consortium to build and operate the Sadko specialized automatic spacecraft, and for the establishment on the basis of the Applied Mechanics and Electrodynamics Institute and the International Science Teaching Centre of a Cosmos International Space Technology Research Centre. The forms of international cooperation should preferably include work on joint projects and experiments, exchange of undergraduate and post-graduate students and trainees, organization of international seminars and conferences and training of specialists in space technology at the Cosmos Centre.

3. The Moscow Energy Institute

The offers of participation by the Moscow Energy Institute in cooperation in the field of training in the study and utilization of outer space relate to the concretization of participation by the Institute's main departments, which have experience in scientific research on the exploration and use of outer space and the training of specialists at different levels, with the possibility of utilizing the Institute's facilities to resolve problems of cooperation.

Organization jointly with the experimental and design office of an international teaching centre.

Topics of the teaching, practical and research work (in addition to those indicated in proposals by the Institute's Special Design Office for the work of the international teaching centre) are:

- Power supply for spacecraft;

- Electrical equipment for spacecraft;

- Radio communications for spacecraft;

- Navigation;

- Guidance of spacecraft;

- Heat exchange;

- Construction of spacecraft;

- Use of space techniques for organizing knowledge centres and data banks;

- Instruction methodologies using space communications.

The Institute offers to hold, jointly with its Special Design Office and international space organizations, science schools for teachers and students under the general programmes at the Institute's Firsanovka Pioneer Camp, Energiya Sanatorium, Alushtu Sports Centre and Medvezh'e Ozero, Kalyazin and Alushtu testing grounds.

It also offers to participate in the organization of international technical and methodological seminars and schools on issues relating to the investigation and use of outer space for peaceful purposes.

Note: The international seminars and schools can be organized so as to make use of direct space communications.

Participation in international projects and programmes for the use of outer space is possible through the use of the Institute's Special Design Office testing grounds as well as by assigning specialists from the Design Office and the Institute itself as instructors and trainees in foreign scientific centres and institutes on an exchange basis.

## 4. Lenin Byelorussian State University

The proposal envisages work on the construction of next-generation space systems for research on the Earth's natural resources and surveillance of the status of the environment, including the training of specialists in specific problems, in part within the framework of international cooperation.

Work is now being carried out at the Byelorussian State University on the development of new technologies for next-generation space systems, on laser-spectrum diagnosis and investigation of the optical characteristics of the environment and natural formations. Specialists are being trained in these subjects. The work is being carried out in the Departments of Quantum Radio Physics and Optical Electronics and in the laboratories of the Scientific Centre for Remote Sensing of the Earth's Natural Resources of the Byelorussian State University.

The basic areas covered by the planned work are as follows:

- Development of light reflectors on the basis of mirror-symmetrical geometry and the development of full navigation systems on that basis;

- Development of light-reflecting panels with the required light-reflection indicators and modulators with a rotating polarization plane, decreasing the weight and dimensions of light-reflecting panels installed on space objects and increasing the axial force of the reflected light;

- Development of the principles of broad-band spectroscopy of surface and remote sensing of the Earth based on the physical phenomena of elastic Raman scattering of light and the luminescence of objects in the environment;

- Development of systems of mobile modular apparatus (designed to operate in mobile ground and on-board aerospace systems) with high space and time resolution.

5. A. N. Sevchenko Scientific Research Institute for Applied Physical Problems of the Byelorussian State University

The Institute has acquired a good deal of experience in the development of remote methods for investigating the environment and in the construction of optical-range aerospace spectrographic equipment.

Microprocessor videospectropolarimetric systems of the "Gemma" series have been used successfully over a number of years aboard the "Mir" scientific orbital station and in laboratories on board aircraft and helicopters. The equipment has also been used in international experiments with the "FIFE-89" land surface climatology satellite in the state of Kansas in the United States.

Joint research could be conducted on the following topics:

- Development and construction of videospectropolarimeter aerospace systems for observing and monitoring the state of the environment;

- Metrological certification in aerospace surveying systems and the development of specialized means of high-accuracy calibration of spectrographic equipment;

- Development of methods for atmospheric correction of videospectropolarimeter data from spacecraft and aircraft and the methodology for determining the optical and physical parameters of the atmosphere and the surfaces beneath it;

- Development of effective methods of determining from space the character, physical parameters and degree of man-made alteration of the environment (aerosol discharges into the atmosphere, condition and degree of pollution of vegetation cover, water, etc.);

- Development of methods for the optimal use of videospectrographic information and the creation of joint thematic aerospace data banks.

The results of the joint work on the topics enumerated above can be utilized effectively in setting up a full-time ecological station in orbit, on board the "Mir" scientific orbital station, and in solving the problems of global observation of the environment from high-orbit satellites.

Cooperation is also possible within the framework of the current international programmes of UNEP and MAB.

6. Byelorussian State University Scientific Research Institute for Physico-chemical Problems

Precision measurements of the chemical composition and dynamics of gases in near and deep space and in the vicinity of space planes are of practical interest, opening up new possibilities for predicting the global environmental consequences of human technological activity, increasing the operating reliability of space technology and clarifying the fundamental laws of the evolution of stellar and planetary systems.

The Institute proposes joint research on one of the promising ways of improving equipment for the contact analysis of rarified gases in space, which involves the use of gas sensors - promising new analytical instruments whose operating principle is based on recording the changes that occur in the electrophysical characteristics of the regions close to the surface of a semiconductor when molecules of the gases to be analysed are absorbed. These instruments combine sensitivity and resolving power (both for types of neutral molecules and ions, and in terms of their kinetic energy, including the ultra-weak range) with exceptionally small dimensions and low power consumption. At present these possibilities are only beginning to be realized, in view of the inadequacy of our knowledge of the complex physico-chemical processes taking place on the surface of the primary semiconductor devices involved in their technology and functioning.

Basic lines of joint work:

It is proposed that the results obtained in this research be developed and the corresponding technology worked out for the development of a range of semiconductor gas sensors and analysers designed to detect rarified gases and rarified molecular currents in a vacuum with a sensitivity of up to $10^{-13}$ Pa equivalent equilibrium pressure; on the basis of such instruments, specialized instrumentation packages need to be developed to solve the following scientific and applied space problems:

- Description of the chemical content, direction and speed of neutral molecules and ions of specific components of the "natural" gas medium of near and distant outer space ("molecular astronomy"), including the parameters of the outer atmosphere of planets and their satellites, of asteroids, and of the neutral components of the solar wind and the interstellar gas;

- Analysis of the evolution of the trajectories and other parameters of artificial molecular probes;

- Environmental monitoring of near space;

- Analysis of the characteristics of space planes' own external atmosphere, highly sensitive external control of the gas and/or water-tightness of compartments of space planes and containers for process gases and liquids;

- Development of new autonomous navigational instruments for space planes based on measurement of the parameters of the gas envelope.

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